

SHOWCASES

2003

Federal Energy Saver Showcases



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

FEDERAL ENERGY
MANAGEMENT PROGRAM

Introduction

The Federal Energy Saver Showcases for 2003 demonstrate how much the agencies of the federal government are doing to use resources wisely. In addition to saving energy and water, the 20 federal facilities described in this booklet are saving an estimated \$15 million per year or more in utility-related costs. These cost savings are the direct result of recent projects featuring energy and water efficiency, sustainable designs and practices, and renewable energy.

The 20 new showcases are in good company. They join about 140 others that have been designated Federal Energy Saver Showcases by the Department of Energy (DOE) through its Federal Energy Management Program (FEMP) since 1996. Combined, all the showcase projects will save more than 249 gigawatt-hours of energy and more than 980 million gallons of water, every year.

These projects succeed not only because of the dedication and commitment of the federal agencies involved, but also because they reflect the expertise and contributions of many project partners. Agency partners include private energy companies, utility service providers, and staff in FEMP and at the DOE national laboratories. These partners

typically contribute utility and product rebates, creative financing options, technical and design assistance, and low- or no-cost energy audits, among many others.

The Federal Energy Saver Showcases have their origins in Executive Order 13123, Section 406(e), which directs agencies to identify candidate facilities. Showcases are selected according to how they meet the requirements of the Executive Order, as well as on their overall effectiveness. Selection also might take into account the historical significance of a building, how many nonfederal visitors it receives each year, and how it would educate visitors about resource efficiency. Showcases are often the result of projects that are easy to replicate and that have leveraged both private and federal funds.

Through the Federal Energy Saver Showcase program, agencies can demonstrate and share with others the many ways that they are improving efficiency and reducing costs. FEMP commends all its agency partners for their many successful efforts to conserve energy and water, save taxpayer dollars, and help preserve our environment.

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Annex Building

**General Services Administration
Social Security Administration
Baltimore, Maryland**

"Reduce, reuse, and recycle" can apply to federal buildings as well as consumer products. That's what the Social Security Administration (SSA) decided when its 475,000-square-foot Annex Building in Baltimore needed a complete renovation. SSA and the General Services Administration (GSA) opted to improve and reuse the existing structure rather than build an entirely new one. This decision in favor of sustainability saved more than \$25 million in new construction costs and enabled 76 percent of the building's interior to be reused.

The building has been redesigned around an open office plan, to allow natural light to diffuse throughout the interior floor plate and reduce the need for internal partitions. Skylights bring light into interior spaces on the third and fourth floors, augmented by efficient light bulbs and low-wattage electronic ballasts. These lighting upgrades have reduced lighting energy use in the building by 32 percent.

Other upgrades include thermal ice storage, economizers, and energy-efficient heating, ventilation, and air-conditioning (HVAC) equipment, as well as automatic shut-off and low-flow bathroom fixtures. The building's façade was replaced with a new, well-insulated wall, and the roof was upgraded with a highly reflective roofing surface. These upgrades improved the building's shell performance and reduced heating energy costs by 50 percent.

Because of these improvements, the Annex Building exceeds the efficiency requirements of ASHRAE 90.1-1999 by a total of 12.8 percent. Technologies used in this building, which received a Leadership in Energy and Environmental Design (LEED) rating for its sustainable design, have also been implemented in SSA's Child Care Facility. And they will be incorporated in SSA's Operations Buildings Renovation Project, which began in September 2003.



Kevin Reals/PX12722



NOAA/PX12726

Atlantic Oceanographic and Meteorological Laboratory

**Department of Commerce
National Oceanic and Atmospheric Administration
Miami, Florida**

The Atlantic Oceanographic and Meteorological Laboratory—operated in Miami by the National Oceanic and Atmospheric Administration (NOAA)—needed help with its building's systems. An old, inefficient, air-conditioning system failed frequently, causing employees to be sent home for one to three days and interfering with productivity. Outside air damper controls would get stuck in the open position, enabling cool air to escape and requiring maintenance costing thousands of dollars annually. NOAA also hoped to replace and upgrade the building's original lighting system, which was installed in 1973. Because all these improvements were costly and exceeded available funding, NOAA turned to alternative financing to complete this renovation project under a utility energy savings contract, or UESC.

As a result, new HVAC controls were added, as well as a thermal energy storage system, which shifts some of the HVAC load to less expensive off-peak hours. The energy storage system displaces 160 tons of cooling from the building, significantly reducing demand. An energy management system is used to operate outside air dampers and exhaust fans, which are shut off during unoccupied periods. And carbon dioxide sensors monitor five air handlers, allowing them to operate only as needed to maintain the building's air and temperature requirements. The building's lighting system has also been replaced with one that provides the same amount of light or more but that costs less to maintain and has better color rendition.

These new technologies and badly needed improvements to the building's infrastructure have reduced the laboratory's electricity demand by almost 40 percent. Resulting cost savings to the government are estimated at \$45,821 per year. NOAA is using this project as a model for completing other energy efficiency projects where appropriated funds are limited. Similar projects have already begun at NOAA facilities in other parts of the country, such as California and Washington.



John Porter/PX12707

Caribou Weather Forecast Office

**Department of Commerce
National Oceanic and Atmospheric Administration
Caribou, Maine**

The Caribou Weather Forecast Office in Maine is viewed as the most advanced energy-efficient facility in the National Weather Service's inventory. In fact, it is considered a prototype for future weather forecast offices (WFOs), and it's being considered for a silver LEED rating, the third highest. The building also serves as a model for design, building materials, equipment, safety, security, and lightning protection. Estimates indicate that the building is not only saving energy—as much as 73,056 kilowatt-hours per year—but also reducing carbon dioxide emissions—an estimated 37,727 kilograms annually.

The “green” design of the Caribou WFO began at ground level, with the selection of the site. The best location for the new structure was the site of an aging airplane hangar. Because reusing the site significantly decreased the area covered by the old airport's paving and increased landscaped areas, more than 50 percent of the surface area is no longer impervious to water. The old asphalt pavement was completely recycled and reused as aggregate for a new driveway.

The building is oriented to harvest the sun's light year-round and its warmth during winter. Daylighting is the primary source of daytime light in most areas of the building, and employees can adjust light levels based on their needs. It is also heated and cooled by a geothermal system, which eliminates the need for refrigerants that are harmful to the atmosphere. And instantaneous hot water heaters save energy while they provide hot water on demand.

Many other green decisions were made in the building process. These included using recycled content in 50 percent of all the building materials and diverting 75 percent of the project's waste from landfills by salvaging, reusing, or recycling it.

Cogeneration Plant, Building 1579

**Department of Defense, Marine Corps
Marine Corps Air Ground Combat Center
Twentynine Palms, California**

To help combat California's recent energy crisis and increase the base's energy security, staff at the Marine Corps Air Ground Combat Center in southern California decided to install a cogeneration plant,



Gary Morrisett/PX12709

which produces both heat and electric power. It is currently the largest such plant in the United States. This 7-megawatt combined heat and power (CHP) plant provides an electric power supply for critical base loads in the event of interruptions in utility power. It can also isolate critical base loads, even when power from the utility is available.

The CHP plant produces electricity and heat to support the majority of the energy and hot water needs of the base's buildings and homes during winter and a large portion of the cooling load during summer. The excess thermal load produced from the cogeneration plant can be used to energize three new absorption chillers that will also be installed.

The project was financed through an ESPC. It will reduce electricity purchases at the base by nearly two-thirds, saving an estimated \$5.8 million in annual energy costs. These cost savings will be applied toward future projects, enabling additional energy-saving and sustainable equipment to be financed. In fact, a new renewable energy project is already in progress: a 1.1-megawatt PV system for the base. DOE FEMP provided the feasibility study for the renewable energy project.

Coleman Barracks, Building #57

**Department of Defense, Army
Mannheim, Germany**

The roof of Coleman Barracks Building #57 at the U.S. Army base in Mannheim, Germany, was damaged and in need of repair. At the same time, staff learned about a local government incentive program for renewable energy. With both incentives, the staff realized they had at least two good reasons to install a new photovoltaic (PV) solar electric system on the building's roof.

In the German government's incentive program for installing renewable energy systems such as PV, 0.47 Euro (the equivalent of about \$0.57 in the United States) is reimbursed to the owner of the system for every kilowatt-hour produced by renewable energy that goes to the local electricity supplier. This reimbursement program significantly improved the economics of a renewable energy system for the Army base in Germany.

In addition, simultaneously installing PV panels and repairing the building's roof allowed the base to conserve manpower and save money on both tasks. Ultimately, this will also save energy and reduce atmospheric emissions.

Power from the 24,942-square-foot, 10.4-kilowatt rooftop PV system is fed into the public electric grid. The Base Support Battalion then receives a credit on its electric bill for each kilowatt-hour produced. Savings were estimated to be 12,000 kilowatt-hours per year, but that goal was reached in less than 10 months.

This project has been so successful that plans have already been made to replicate it. The base hopes to install PV systems on three more buildings this year. The FY 2004 plan includes money to install systems on two of the buildings, which have a total area of about 100,000 square feet.



Witch Menz/PX12727

Dahlgren Division, Naval Surface Warfare Center

Department of Defense, Navy
Dahlgren, Virginia

In 1990, energy use per square foot at the Naval Surface Warfare Center Dahlgren Division in Virginia was at its highest levels. Staff began to realize that a major culprit was the poorly operated, inefficient HVAC system on the base. So, in FY 1991, as part of a MILCON construction project, the first fiber-optic cable direct digital control (DDC) system was installed. As a result of this project, 60,000 input/output points in 108 buildings are now controlled by a single DDC system, covering the equivalent of 80 percent of the total square footage of the entire facility.

The first priority for the DDC retrofits was to replace control systems that were failing. The second priority was to address the need for improved comfort control, energy savings, and a reduction in the number of related service calls. The new system has met each of these priority requirements. In addition, it is capable of shutting down HVAC systems base-wide in mere seconds. The DDC system has saved nearly \$7 million in energy and operation and maintenance (O&M) costs since its inception.

Extra control points were later installed to provide a better diagnostic capability, dramatically reducing the time spent on HVAC service calls. Many service calls are now handled at the DDC monitoring station without the need for an on-site visit.

A variety of other energy-related projects have been implemented at this center, as well. They include electrical and water metering, combustion efficiency, carbon dioxide monitoring, and a new, solar water heating system.



George Denslow/PX12704

Dyess Air Force Base

Department of Defense,
Air Force
Dyess Air Force Base, Texas

Dyess Air Force Base is just outside Abilene, Texas, in a semi-arid region prone to drought. From 1998 through 2001, the region's average rainfall was 75 percent of normal, and the potable water supply was less than 30 percent. The base consumed more than 300 million gallons of potable water per year, or approximately 5 percent of the city of Abilene's annual usage. So Dyess staff decided to seek ways to reduce their water consumption and help the surrounding communities, as well.

They determined that using effluent water for irrigation could help reduce Abilene's potable water usage by 2 percent, or about 160 million gallons, annually. But the effluent water line was 7 miles east of the base, which meant they had to find an economically feasible way to get the water through town. Then, they found out that Chevron Oil no longer used a 10-inch steel line that ran across town 2 miles south of the base. Chevron was able to turn over the rights to the pipe to Dyess. The city of Abilene then sliplined an 8-inch high-density polyethylene pipe into 16,000 feet of the old Chevron pipe and constructed 20,000 feet of new line from the old Chevron pipe to Dyess.

At the same time, Dyess made use of an energy savings performance contract (ESPC) with Siemens Building Technologies to help with the project. The contract allowed them to add a pair of 11-million-gallon holding reservoirs, two pump stations capable of pumping more than 2,000 gallons per minute, and more than 3 miles of distribution piping to connect the base irrigation system.

Dyess personnel also negotiated the procurement of 100 percent of the base's electricity from wind energy sources in August 2002. This is more than 78 gigawatt-hours, and it is the largest single purchase of renewable power in the United States. It also represents more than 20 percent of the entire federal government's procurement of renewable energy. Dyess intends to continue to purchase 100 percent renewable energy after the current contract is up in December 2004.



NSWCDD Public Works/PX12711

Fairchild Air Force Base

Department of Defense, Air Force
Fairchild Air Force Base, Washington

Fairchild Air Force Base has found some very creative ways to finance its much-needed improvements. For example, using a combination of alternative financing and appropriated funds, the base has been able to purchase a variety of energy-efficient technologies as well as renewable energy. In one ESPC project, an outdated central steam plant was replaced with more efficient boilers in 78 buildings, helping the base to reduce its energy use by 33.4 percent from a 1985 baseline in just one year.

Meanwhile, in UESC projects with Bonneville Power Administration, light pipe technology and infrared radiant heat were installed in hangars, hangar doors were realigned, and weather-stripping was added to save even more energy. To reduce water consumption, the base is relining sewer piping and installing an automated irrigation system under another UESC.

The base has used appropriated funds to improve the efficiency of its HVAC systems. At a cost of less than \$1,000 per hangar, an energy management control system (EMCS) was installed to set back temperatures in seven unoccupied hangars. The same system manages a rolling shutoff of air conditioning in the summer during times of mandated curtailment. It can also shut down air-handling units in 100 buildings in less than 10 minutes.

To increase the use of renewable energy at the base, Fairchild purchases more than 7,800 megawatts of wind power. The base also buys an additional 3,500 megawatts or more of green power each year from a variety of sources, including wind, hydropower, solar, and geothermal.

All these improvements are saving more than 59 million kilowatt-hours per year, for a 20.6 percent savings over the previous year's usage. But Fairchild's staff is also looking toward the future. In FY 2004, they plan to buy 100 percent of the base's electricity from wind or other green power sources. They're also studying energy-saving opportunities in 23 buildings and plan to pursue several opportunities in the near future.



Bonneville Power Administration/PX12713



Susan Galentine-Ketchum/PX12724

Fort Carson Green Training Building

Department of Defense, Army
Fort Carson, Colorado

Fort Carson's commitment to sustainability is very apparent in a new training building at this Colorado Army base. In 2001, staff formed a "green building team" to set standards and ensure the successful integration of sustainability concepts into a training facility funded for construction in 2002. This project provided an opportunity for the U.S. Army Forces Command not only to acquire new sustainable facilities but also to apply the Army's Sustainable Project Rating Tool (SPiRiT) on a local level. The new building ultimately attained a silver SPiRiT rating.

The facility measures 2,800 square feet and includes a training room that can hold up to 70 occupants, a state-of-the-art audiovisual system, two restrooms, a lobby, a storage area, and an office. Sustainable elements were incorporated into all aspects of the building, including its design, energy-efficient equipment, recycled-content construction materials, and interior furnishings. The building incorporates daylighting and high-efficiency, operable windows to reduce energy use for heating and cooling. A natural cooling cupola eliminates the need for air conditioning. The windows, furnace, and exit signs all have an ENERGY STAR® efficiency rating.

Other sustainable features of the facility include interior paint containing a low amount of volatile organic compounds (VOCs) and a sub-slab vent system; both contribute to better indoor air quality. In addition to being built of materials with recycled content, the building also incorporated and reused products from the demolition of an older building, such as paper towel dispensers and bathroom handrails. An exterior PV-powered light provides building security with energy reliability. To reduce water consumption in this arid locale, designers also incorporated low-flow toilets and urinals, metered faucets, instantaneous water heaters, and xeriscaping techniques.

Grand Forks Air Force Base

Department of Defense, Air Force
Grand Forks, North Dakota

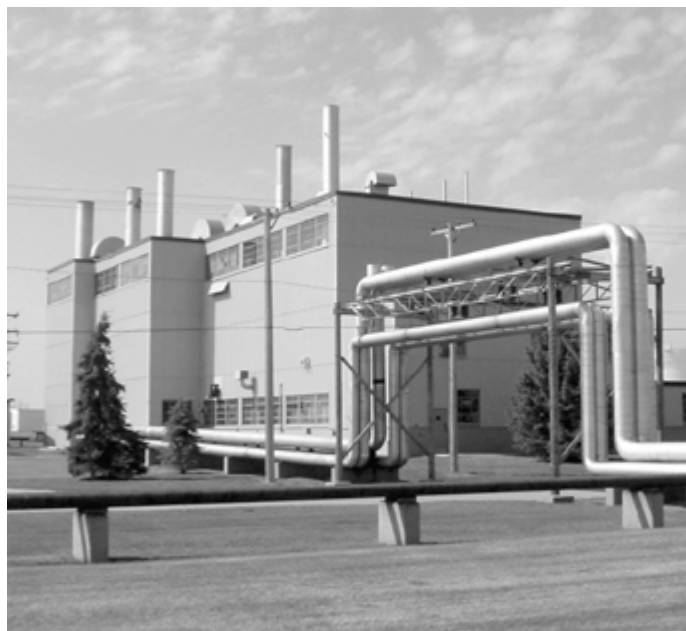
In 1999, Grand Forks Air Force Base in North Dakota became the very first to use an ESPC in Air Mobility Command. That contract allowed the base to fund more than \$28 million in infrastructure and energy conservation projects with zero outlay of government dollars.

Distributed high-efficiency boilers, infrared radiant heaters, and hot water heaters were installed in 113 buildings, allowing the outdated and inefficient central heat plant to be decommissioned. Energy savings are being realized through increased equipment efficiency, elimination of distribution losses, and heat plant operational savings. The base replaced other aging equipment and eliminated an expensive utility operation contract; it also demolished above ground hot water lines along with the heat plant. The ESPC contractor installed natural gas lines to all the buildings, providing the base with a new, decentralized infrastructure having an estimated 50-year life. Projected savings over the contract term exceed \$55 million.

A synthetic natural gas (SNG) plant on the base was also constructed under the ESPC; it can provide alternative fuel for the natural gas system. The plant allows the base to take advantage of a reduced "interruptible" natural gas rate, which is expected to save up to \$13 million over the contract period. During times of high demand on the local commercial natural gas system, the supplier can curtail gas to the base, freeing up capacity for others. The base can then use the SNG plant to provide a replacement gas.

Efficient lighting was also installed in 10 base facilities. This lighting is more comfortable for the occupants and saves a projected \$1.1 million over the life of the contract.

The results of these ESPC projects have exceeded all expectations on the base. For example, natural gas savings during FY 2002 were more than 185,000 million British thermal units (MBtu), for a cost savings of \$2 million and a 29 percent reduction in natural gas usage from the previous year. Another benefit goes beyond Grand Forks, as the knowledge acquired during the project is passed to other bases through consultations. This increases the value of Grand Forks' experience many times over.



Matthew Dunston/PIX12/16



Jim Dayton/PIX12/00

Herbert H. Bateman Educational and Administrative Center

Department of the Interior
U.S. Fish and Wildlife Service
Chincoteague National Wildlife Refuge, Virginia

Chincoteague National Wildlife Refuge, which covers all or part of several islands and a small part of Maryland as well as Virginia, is one of the most frequently visited national wildlife refuges in the nation. Its ideal location enables the U.S. Fish and Wildlife Service to educate millions of people about its mission. The Service actively engages visitors in the conservation of such natural resources as the endangered Delmarva Peninsula fox squirrel and the threatened bald eagle. Its new Educational and Administrative Center will enable the Service to manage the refuge safely and efficiently as well as reduce accidents and law enforcement incidents, such as trespassing into wildlife nesting areas.

The new center was built using a holistic, sustainable approach. Project members focused on protecting wildlife and minimizing the disturbance of habitats by constructing the building on a site that was already developed. The staff eliminated nearly \$800,000 worth of backlogged maintenance costs by replacing five inadequate buildings constructed in the 1960s that cannot be rehabilitated. Some of the land now occupied by the old buildings will revert to wildlife habitat.

The center incorporates a variety of renewable energy technologies, including passive solar design strategies and 23 geothermal heat pumps for the building's cooling and heating needs. Energy-efficient lighting, low-emissivity (low-e) windows, natural cross ventilation, and light tubes for exhibits have been incorporated into the design. Ninety percent of the center benefits from daylighting and scenic views. Passive solar features such as sunshades are also used throughout.

These features combined reduce the center's energy use by 50 percent in comparison to a similar facility's usage. Rapidly renewable materials were used for construction wherever possible, and there is on-site recycling at the site for both workers and visitors. In addition, low-flow showers, faucets, and waterless urinals, along with natural wastewater treatment and xeriscaping, save two million gallons of water annually.

Jefferson Laboratories

Department of Health and Human Services
Food and Drug Administration
Jefferson, Arkansas

Its mission is to protect consumers and promote public health. To support that mission, the Food and Drug Administration (FDA) in the U.S. Department of Health and Human Services (HHS) performs biological research on the toxicity of FDA-regulated products. One of the major facilities for conducting this research is Jefferson Laboratories (JL) in Arkansas. This energy-intensive facility has 38 buildings that house 600 employees performing research in general-purpose and high-containment laboratories, animal breeding and holding rooms, and pathology laboratories.

In FY 1999, JL entered into a UESC with Entergy Arkansas, Inc., in which eight energy efficiency projects were completed; a ninth project is in progress. These projects represent almost \$10 million in energy investments. Savings are estimated to be 127,701 MBtu per year, worth about \$848,334 annually; 10-year net savings are estimated at \$1.3 million.

In these UESC projects, variable-frequency-drive controllers were installed on pump and fan motors to reduce energy consumption, and new power factor correction capacitors were added to improve facility operations. Energy-efficient lighting and the use of natural daylight along the perimeter of the building reduce energy use while improving lighting levels and occupants' comfort. New, low-flow plumbing fixtures reduce water consumption in the restrooms.

Because they have high air-exchange requirements, laboratories consume a great deal of energy. So, to reduce that consumption, additions included exhaust-air energy recovery, variable-air-volume fume hoods, free-cooling economizer cycles on air-handling units, and district cooling improvements. As a result, the labs as a whole can boast of a 39 percent reduction in energy consumption.

These successful projects will continue to be publicized to promote the use of UESCs throughout the agency. As a part of these efforts, JL personnel receive energy awards, are featured on energy awareness posters, and give presentations on UESC projects at HHS seminars.



Bruce Rice/PIX12759



David Niebergall/PIX12714

Laughlin Air Force Base, Buildings 241, 244, 246, 253, 255, and 256

Department of Defense, Air Force
Laughlin, Texas

Laughlin Air Force Base in Texas is learning first-hand how much energy and money can be saved by upgrading heating, cooling, and lighting equipment with financing obtained through an ESPC. A six-building complex on the base centers around a central hot- and chilled-water plant (Building 244). Each building was evaluated through the Air Force Region 6 ESPC and placed in one of two projects. They were all modified to greatly improve energy efficiency and manage demand.

In all, the first project involved ten major changes to the plant, and the eleventh should be completed before the end of 2003. The heating and cooling plant was reconfigured to allow simultaneous production of heat and cooling as it serves a mixture of two-pipe and four-pipe systems. Additions included a direct digital facility automation system, variable-frequency drives, and a water-side economizer system with a 110-ton plate heat exchanger. The water chillers in two buildings were deactivated, and those buildings were connected to the water chiller in the central plant. To help make up plant capacity for the two additional loads, a thermal ice storage system was installed and the main chiller in the central plant was replaced. The new chiller uses R-22 instead of the ozone-depleting R-11 refrigerant that the old one used; this change eliminated 25 percent of the entire base's requirement for R-11.

The second project involved energy-efficient lighting retrofits, which were completed in three buildings. These included the conversion of T-12 lamps with magnetic ballasts to T-8 lamps with electronic ballasts. Fluorescent fixtures were also retrofitted with polished reflector kits, and incandescent exit light fixtures were converted to LED exit lights. Regular incandescent fixtures were retrofitted with compact fluorescent lamps.

Building 244 improved the most as a result of the projects, but each building benefited. Cost savings resulting from all the improvements should be more than \$1.9 million over the 20-year life of the contract.

Additional lighting retrofits are on tap for the next ESPC project, and an old, leaking boiler is scheduled to be replaced by two staged boilers to further enhance energy efficiency.

Marine Corps Air Station Beaufort

Department of Defense, Marine Corps
Beaufort, South Carolina

An energy management control system is saving taxpayer dollars as well as energy at this Marine Corps Air Station (MCAS) in Beaufort, South Carolina. As part of an energy conservation project aimed at reducing shore facility energy consumption by 12 percent, MCAS Beaufort teamed up with Pacific Northwest National Laboratory to install a \$2.6 million EMCS. The system sets heating and cooling levels, controls lighting, and manages peak loads in numerous buildings on the base. The project team targeted buildings that would provide high energy-savings paybacks for investments in new HVAC system and lighting controls.

Most of the targeted buildings were barracks, office areas, and hangars with lighting controls that were not in use the entire day. Occupancy controls, temperature monitoring controls, and light-level controls were added to many buildings. A base-wide local-area network was also established for the EMCS; this feature allows the MCAS to monitor incoming power usage and automatically control peak demand load-shedding. As a result of this project, energy and lighting in 49 buildings are now being managed from a central location.

This system is saving more than 34,000 MBtu annually, or about \$624,000 in energy costs. The project has also had a large impact on maintenance costs, because technicians can now monitor and program controls for multiple buildings from a central location.

This project has been so successful that additional buildings are being evaluated to receive the same upgrades. Eventually, heating, cooling, and lighting in every building on the base will be controlled by the centralized system.



Brendan Osban/PX12719

McConnell Air Force Base

Department of Defense, Air Force
McConnell AFB, Kansas

A \$650,000 project at the 22nd Medical Group, the base's medical clinic, is the largest recent energy-saving activity to date on this Air Force base near Wichita, Kansas. In this project, two high-pressure, natural-gas-fired steam boilers were replaced with more efficient, gas-fired, pulse combustion boilers. The new boilers eliminated the need for a \$290,000-per-year service contract to monitor and maintain the old boilers.

At the same time, the base's conventional air-conditioning chillers were replaced with a new, rotary chiller unit. This improvement resulted in more uniform and more comfortable temperatures throughout the facility, significantly enhancing the working conditions of the staff and the comfort of patients, while saving energy.

A wide variety of upgrades were also completed across the base. These included replacing inefficient, short-life boilers in Dorm 350 with an efficient, long-life domestic hot water boiler and a scotch marine boiler. In Building 795, a degraded chilled-water cooling system was also replaced with a modern, more efficient cooling system. And one hangar with an old, high-pressure steam heating system that had come from another building was given a lift with a new, low-pressure hot water system. This was accomplished by installing a boiler in the hangar.

In addition, system engineers and maintenance employees have been proactive in ensuring that in-house procedures encourage energy efficiency. The HVAC shop focuses on finding, correcting, and upgrading inefficient systems; it works closely with maintenance engineering staff for their expertise and advice on new projects. The maintenance shop replaces failed water heaters only after analyzing present capacity requirements. Often, original, oversized heaters can be replaced by smaller, more efficient ones at less cost. These personnel efforts, combined with the energy efficiency measures, are resulting in an estimated annual energy cost savings of \$65,000 at the base.



Belton Tisdale/PX12723

Oroville-Osoyoos Border Crossing

**General Services Administration
Oroville, Washington**

The Oroville-Osoyoos Border Crossing in Washington State was conceived and constructed in 2002 to showcase innovative, sustainable technologies. The project was unique in that it involved international cooperation between the U.S. and Canadian governments, including such agencies as the GSA, DOE FEMP, and the Canadian Customs and Revenue Agency.

At the heart of this project is a sustainable energy technology known as a ground source heat pump (GSHP) system, which is used in the production of high-efficiency heating and cooling. The benefits of the system include reductions in maintenance costs, energy consumption and costs, and greenhouse gas emissions, in comparison to those associated with many traditional heating and cooling technologies. The GSHP saves almost 5 million kilowatt-hours of electricity per year in comparison to the energy consumption of a conventional system for a facility of this size.

Sustainable technologies in the building also include recycled construction materials, such as steel and studs, and concrete made of fly ash. Low-VOC paints were used to reduce adverse impacts on indoor air quality. Occupancy sensors, T-8 lamps with electronic ballasts, compact fluorescent lamps, and variable-frequency drives were also selected. Automated irrigation and low-maintenance native landscaping were installed to conserve water and reduce outdoor maintenance requirements. All these features combine to make the facility a model of sustainable building and landscaping practices.

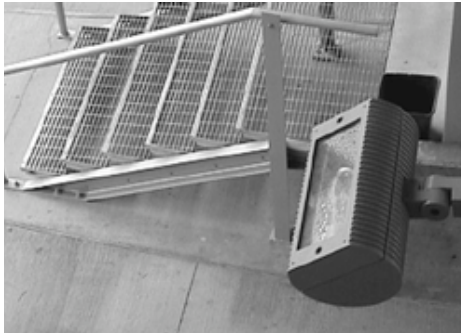
Travis Air Force Base Department of Defense, Air Force Travis, California

Energy savings performance contracts save money formerly spent on maintenance, as well as energy, as shown in an ESPC project recently completed at Travis Air Force Base in California. Upgrades financed under the ESPC are improving facility operations, while reducing energy consumption and costs, as well as O&M requirements, on the base.

The first part of this project involved replacing three inefficient, outdated steam boilers with six compact, highly efficient pulse hydronic boilers. Thanks to their compact size, the boilers could be placed close to air handlers in existing mechanical rooms. In addition, the new boilers have low emissions levels and no longer require operating permits from the local air quality district. This not only eliminates permitting fees, it also reduces the O&M requirements associated with the old boilers.

To optimize their performance, the new boilers are fully controlled by the base's energy monitoring system. This straightforward upgrade is estimated to save \$57,842 in energy costs and \$263,985 in maintenance costs annually. Honeywell, the energy services company under the ESPC, provides maintenance services as well as equipment for the boilers.

The project also included lighting retrofits in 51 buildings throughout the base. Magnetic ballasts and T-12 fluorescent lamps were replaced with more efficient electronic ballasts and T-8 lamps. The lighting project should reduce previous lighting energy use by 53 percent, while the boiler replacement will reduce boiler energy use by an impressive 72 percent.



General Service Administration/PIX12702



Chad Moeller/PIX12712



Courtesy of USDA/PIX12720

U.S. Arid Land Agricultural Research Center

**Department of Agriculture
Maricopa, Arizona**

To support its research mission, a new facility in Maricopa, Arizona, is being designed with energy and water conservation in mind. The U.S. Arid Land Agricultural Research Center will support research at the U.S. Water Conservation Laboratory and the Western Cotton Research laboratory in a highly sustainable way.

The building's orientation, as well as its use of daylighting in all workspaces, will dramatically reduce energy consumption. Occupancy sensors and automatic daylight controls will be installed to conserve the energy used for lighting. Direct digital controls will minimize the energy consumption of the building's mechanical systems. Variable-frequency pumps and fans, proper commissioning of the building's systems, and the use of water-saving, low-flow plumbing fixtures are also considered important design elements.

Because laboratory spaces have greater requirements for ventilation than most other building areas, they typically consume a large amount of energy. Several technologies will minimize the energy use in these spaces at the research center. Labs will have a night setback capability, which reduces air-conditioning needs in the evening by lowering fume-hood flow requirements to an allowable minimum. When the labs are occupied and full-flow conditions cannot be avoided, the energy used by both the supply and exhaust equipment will be optimized through the DDC system.

The laboratory exhaust system will incorporate heat recovery coils to capture the energy in exhaust air and return it to the heat recovery coils in the lab building. The laboratories have also been designed to promote the sharing of fume hoods, thus reducing the total number of hoods needed and their exhaust requirements. If the budget permits, a variety of water reclamation technologies will also be included in this research center.

Watervliet Arsenal, Buildings 19, 110, and 115

Department of Defense, Army
Watervliet Arsenal, New York
Champaign, Illinois

In FY 2001, Congress appropriated funds for the Department of Defense to begin its Residential Proton Exchange Membrane (PEM) Fuel Cell Demonstration Program. This program was slated to be led and coordinated by the U.S. Army Engineer Research and Development Center's Construction Engineering Research Laboratory. A private firm, Plug Power, was awarded funding to install ten 5-kilowatt fuel cell units at the Watervliet Arsenal in New York, the oldest continually active arsenal in the nation.

The project was a collaborative effort among staff of the U.S. Army Corps of Engineers, Plug Power, and the Watervliet Arsenal. They installed the PEM fuel cells to demonstrate the way in which fuel cells can support the Army's training, readiness, mobilization, and sustainability missions with a clean, reliable energy supply.

Watervliet Arsenal has benefited from these PEM fuel cell installations through the energy savings they afford, as well as from their environmental advantages. The demonstration program has provided operational testing and validation of PEM fuel cells to assess installation requirements, grid interconnection, system operation in all seasonal conditions, and integration of the units into a military base environment. In short, the arsenal provided a good site for demonstrating a potential military base market for PEM fuel cells.

During the one-year demonstration of this cutting-edge technology, Watervliet Arsenal has saved almost \$6,000 in energy costs. It has also reduced pollutant emissions by making use of locally generated, clean power instead of power purchased from the local utility. The results of this demonstration program and the lessons learned from it will be invaluable for future installations.



Franklin Holcomb/PX12705



Jim Fuller/PX12758

White River Facility Operations Center

Department of the Interior
National Park Service
White River, Washington

The White River Operations Center in Washington serves as a fee collection site, wilderness information center, and provider of basic visitor services. It also houses 14 park employees from May through November. But it is in a remote site and cannot be connected to an electric utility. Since it opened in 1931, its power had been provided by traditional generators operating 24 hours a day. They were sized to accommodate peak loads, so a great deal of energy was wasted during off-peak hours. And noise from the generators affected both wildlife and employees, while emissions became a concern in what is now a class-one air quality zone.

So, the National Park Service (NPS) worked with Washington State University to find other alternatives. They found an ideal solution: a hybrid PV system that combines solar electricity with a small, backup propane generator. The new system currently represents the largest solar array in the Pacific Northwest.

When heavy winter snow accumulations dealt the final blow to an old garage in 1999, NPS staff thought the replacement might be the perfect platform for a PV array. The design replicated the original structure fairly closely, while incorporating sustainable techniques and adding storage and office space. The roof was designed to optimize solar energy from the PV array as well as to shed snow. To reduce contract costs, the center's electric shop team handled all preliminary work for the hybrid PV system. The team also replaced all energy-consuming devices with energy-efficient ones, greatly reducing the electric load.

In its first year, the system produced 5,359 kilowatt-hours of electricity. And over two years, it saved a total of \$9,810 in fuel costs.

But for those who live in or visit the White River Entrance, the most noticeable benefit is the silence. The new system provides reliable power without the constant drone of generators. It also helps the staff educate park visitors about solar energy.

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